XV.

THE WATER OF THE PLENTY RIVER.

BY JOHN MAUND, M.D.

Some months ago Mr. Jackson communicated to the Institute a paper on the Yan Yean Water Works; I then promised, at the following meeting to read a paper on the chemical characteristics of the water to be supplied by that scheme, but some additional experiments, that I was anxious to perform, has occasioned the delay in bringing it before the Society. Permit me introductorily to premise, that pure water, chemically considered, does not simply mean that it is agreeable in taste, and bright and sparkling in appearance, but that there is an entire absence of all foreign matters. Absolutely pure water consists solely of two gases, viz.:—88·89 parts by weight of oxygen, and 11·11 of hydrogen, or of one volume of the former to two of the latter.

All water in common use contains, in addition, substances which may be regarded as impurities, such as gases which rain becomes mixed with, in its formation in the clouds, and in descending through the air; salts which it dissolves while percolating through various strata in the ground; and decaying animal and vegetable substances, which more or less universally abound on the surface of the earth.

A small amount of the two former groups of substances rarely render the water less desirable for domestic purposes, but these in excess, with organic matter, give to it various peculiarities, such as are termed hardness, softness, and also colour, smell, or taste, which renders it more or less suitable for the various purposes of life.

The water to be supplied from the Yan Yean reservoir will be derived from the Plenty River, and this, with rain water, will be the only source of supply. Analyses therefore of the water, both when the river is low, and also when it is increased in bulk by rain, will afford tolerably accurate knowledge of the character and quality we may expect to obtain when the works are completed. As I have already submitted the water taken from the River Plenty to analysis at various seasons of the year, and from different parts of the stream, I will now very briefly submit some of the results obtained.

The following is a quantitative analysis of the water taken in December, 1853, from that part where the river is to be turned into the reservoir. At this period the river was very low.

CONTENTS OF ONE GALLON, OR TEN LBS. AVOIRDUPOIS.

	Grains.
Carbonate of lime - - - - -	·60
Sulphate of Lime - - - - -	·54
Alumina and Iron - - - - -	·38
Chloride of Magnesium and Sulphate of Magnesia -	·29
Chloride of Sodium - - - - -	1·78
Silica - - - - - -	·91
Organic matter - - - - -	1·22
	5·72

The gas contained in the water was inconsiderable, and this was mostly atmospheric air and carbonic acid. The microscope exhibited little more than the presence of dead vegetable matter and sand.

Water taken at the same period above the swamp gave a total of solid matter of 4·85 grains per gallon, there being only ·37 grains of organic matter.

Another sample of the water obtained at the same period at the Lower Plenty bridge, about ten miles from the reservoir, contained 7·36 grains of solid matter, 1·97 grains of this being organic matter.

From the above statement it will be seen that the greater the distance the water flows so the impurities increase in quantity, particularly as regards organic matter, indeed this we may have expected, especially when the current was to the eye almost imperceptible. In other analyses of the water I have made at different times of the year, derived from the river where it is to be turned into the reservoir, I have found the solid matter to vary from 4¼ to 6¾ grains per gallon, but I believe the detailed analysis represents a very fair average.

If we compare the amount of solid matter per gallon with that of the waters supplied to most English towns, we find that it is greatly superior in point of purity. For instance, the imperial gallon of the following waters contain:—

	Grains per gallon.
East London River Company	23½
New London River Company	19½
Kent Water Company	29¾
Hampstead	35½
Edinburgh	12¼
Durham	15½
Sunderland	27
Seine at Paris	28¼
Rhone at Lyons	12½
Lake of Geneva	10½
River Jordan	73
River Plenty	5¾

I have consulted upwards of sixty analyses of waters supplied to towns in Great Britain and the continent, and I only find one (which exists in Switzerland) that is purer than the Plenty.

There is another circumstance which renders the Plenty water a very desirable one, this is its softness; it being less than two degrees of hardness, while the water supplied to London is upwards of sixteen degrees of hardness. This property too does not impair the taste of the Plenty water, which is extremely fresh and agreeable. Water being soft is of great importance in both a sanitary and economic point of view; thus, it is a much more perfect solvent of all organic substances, and so is preferred for brewing, dyeing, bleeching, and all manufacturing purposes, and this property experience has proved equally applies to the various functions of the human body. Mr. Youatt says, instinct has made the horse conscious of this, for he never will drink hard water if he has access to soft. It also is an immense saving to a population in the simple article of soap, which with hard water forms an insoluble salt with the fatty acids of the soap, thereby rendering it much less applicable for detergent purposes, as the soap has first to unite with all the earthy salts before a lather can be formed. Professor Playfair says with the Thames water thirty ounces of soap are wasted in every 100 gallons of water before a detergent lather is produced; and further states, it has been calculated that in London the amount of soap and soda wasted, in consequence of the hardness of the water, is equal in value to the gross water-rental, and besides this it produces a much greater wear and tear of clothes.

I would not wish it to be supposed that I entertain the opinion that an entire absence of solid and gaseous constituents in the water is desirable for the common uses of life. Far from it, as it would so be reduced to the character of distilled water, the taste of which is vapid and destitute of freshness, and again, when we consider that water forms so important an article of our diet, the ingestion by this means of a small amount of inorganic matter cannot but render it useful in supplying the loss sustained by the daily waste of the body; but where a large amount is contained in the water, it is found to be injurious, and so, often proves the source of derangement of health, and this is especially manifest in particular localities by the greater frequency of urinary and other diseases. Thus, we find Melbourne as it is now supplied from the water containing but a small amount of either earthy, saline, or metallic particles, that such diseases are extremely rare; while, on the other hand, its containing a large amount of decomposing organic matter is doubtless often the exciting cause of that frequent disease amongst us—dysentery.

Specimens of Water Exhibited.

No. 1.—This water was taken in January, 1854, from the Plenty River above the swamp, and has been preserved for the last fifteen months in a well corked stone bottle. It remains perfectly sweet and clear, and tastes fresh as when first derived from the river.

No. 2.—Is water taken at the same period from the Plenty River, at the point where it is to be turned into the reservoir, this remains equally good.

No. 3.—Is some of the same water as No. 2, but, instead of being closely corked, it has been freely exposed to the air. It is in all respects equal to the former.

No 4.—Is some of the same water as No. 3, but the sediment that has been deposited is allowed to remain in the bottle. This is very small in quantity and consists mostly of vegetable matter.

No. 5.—Is some water I received from Castlemaine in March, 1853. It was sent for analysis in consequence of being supposed to have produced numerous cases of dysentery. Its chief peculiarity consists in containing a large amount of organic matter and alumina, it still remains quite sweet, and is as good as when forwarded to me. I exhibit it merely to illustrate a fact that I have often observed in this Colony, viz., that water that contains even a large amount of organic matter seems to have the property of keeping sweet for a long period.

These specimens exhibit to some extent the capability of the water keeping good for a long period, and though they may not absolutely prove that the water in the reservoir will keep equally well, still I have not the slightest doubt, from these and other observations, that if the water from the reservoir be properly filtered immediately before being distributed, we shall not have reason to find fault with its quality. The circumstance of having the water stored in a reservoir, has perhaps been more frequently urged as an argument against the scheme than any other, but this evidently is in a great measure refuted by so many towns in England being supplied with good water from similar sources. The London Board of Health, after carefully examining the subject, and having analyses made of various waters by the first scientific men, proposed to do away altogether with the river supply from the Thames, and instead, distribute entirely rain water, to be collected at Bagshot Heath and its vicinity. Again, a little while ago, the Glasgow city authorities contemplated supplying their town from Loch Katrine instead of from the Clyde. No person who has paid any attention to the keeping of water is ignorant of the fact that organic matter, such as the entomostraceæ and conferveæ are much encouraged by the water remaining stagnant and exposed to the air and light; in the Yan Yean reservoir, however, this will I believe to a considerable extent be obviated, for, in addition to a stream constantly flowing into it, the size of the reservoir is such, that the wind will do much to keep the water in motion. Again, the depth is to be considerable, so that the light will have much less effect in producing organic matter. Careful filtration too will remove from it, not only aluvium, but much of the insect and vegetable life which is certain to some extent to be formed.

Another circumstance, which fortunately the Yan Yean reservoir will possess, is its being at a distance from any town, the air in the country being so much more pure than that where a large population exists, where it is always loaded more or less with noxious gases, which rain in descending becomes mixed with. This impurity of the air is rendered manifest to all living in densely populated towns, by the air feeling much more pure after a thunder-storm, which is occasioned mostly by nitrous acid being formed in the air, and this speedily decomposes exhalations, effluvia, &c. While adverting to this subject, I cannot forbear stating that I believe there is no one circumstance which demands better the attention of the authorities than making such arrangements regarding the reservoir as to preclude a dense population settling near its banks, for, if such is allowed, the surface water after rains is sure to convey into the reservoir a large amount of impurities, which here will be doubly disadvantageous, from there being no current, as in a river, which can convey a portion away, here all must remain in some part of the reservoir till their entire removal by consumption is effected, thereby rendering the water constantly impure.

In stating my opinion that the water to be obtained from the Yan Yean reservoir will not only be excellent, but superior to that supplied to most, if not to all towns in Great Britain, I would not wish it to be understood that I unhesitatingly state the Yan Yean scheme is the best that could have been adopted for supplying Melbourne, for, on this point, I confess, from its embracing so many scientific details, I do not feel myself a competent judge. I may mention, however, as a general rule, that I should prefer, where it is possible, on the gravitation principle, to derive the water directly from a river near its source, so that it could not be subject to contamination, rather than to any plan of storing water in reservoirs.

The only other point I wish to advert to regarding the Plenty water, is its ready action on lead, and this is not difficult to account for, as both experiments and experience have proved that the larger the amount of inorganic constituents a water possesses, so is it less able to act on lead, while the more impure it is, as regards organic matter, so, is it more likely to act on this metal. The following experiments will illustrate the action of the Plenty water on lead. I kept a piece of lead immersed in some of the water for a week, and this water after evaporating to a fourth of its bulk, showed it was contaminated with lead to a sufficient extent, if it were constantly drunk, to produce the poisonous effects of this metal.

This circumstance, therefore, should be a caution to the public against using lead pipes, cisterns, &c., for poisoning by lead in this way is by no means an uncommon occurrence, and from being introduced into the system gradually, it becomes a most insidious poison, producing the most serious derangment of the health, which unfortunately is but slowly, if ever, restored, from the disease being often attributed to other causes.

XVI.

GAS AND GAS WORKS:

CONSIDERED

IN RELATION TO THE PRESENT CIRCUMSTANCES AND REQUIREMENTS OF THE COLONY.

BY A. K. SMITH, ESQ., C.E., F.R.S., &c.

(*Continued.*)

READ JUNE 7, 1855.

Fourthly and lastly, the application of Gas to public and private uses.

The three great arguments at one time advanced against